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Self-rated health and its association with all-cause mortality of older adults in Poland: The PolSenior project

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ABSTRACT

Objectives: Predictive effect of self-rated health (SRH) on mortality in older adults has been observed. The purpose of the study was to analyze this association in Poles aged 65+.

Methods: Data were obtained from the nationwide, multidisciplinary PolSenior project, conducted in a representative sample of older population. The study group comprised 4049 respondents (48.0% women) without significant cognitive deficit. SRH was measured using Visual Analog Scale. The analysis included selected socio-economic, health status and life-style factors. Mortality data were retrieved from the state registry.

Results: During 5-year period, 414 women (21.4%) and 672 men (31.8%) have died, including 17.5% of women and 26.6% of men with good, 21.6% and 32.9% with fair, 36.2% and 55.3% with poor SRH, respectively. Kaplan-Meier survival curves for SRH revealed significant differences for both genders. Univariate Cox regression analysis revealed significant hazard ratios (HRs) for mortality among women and men with poor compared to good SRH [2.48 (1.83–3.37); 2.62 (2.04–3.36), respectively] and those with fair compared to good SRH [1.29 (1.03–1.60); 1.29 (1.10–1.52), respectively]. Age-adjusted HRs for mortality were significant between groups with poor and good SRH [women: 1.98 (1.46–2.68), men: 2.06 (1.60–2.64)]. Multivariate Cox proportional hazard regression model including revealed significant HRs for mortality between women with poor and good SRH [1.67 (1.06–2.64)].

Conclusions: SRH was associated with mortality in both genders. After adjustment for age, this relationship was maintained in respondents with poor compared to good SRH. Inclusion of potential confounders demonstrated that SRH was an independent predictor of mortality only in women.

1. Introduction

Self-rated health (SRH), also known as self-reported, self-assessed or self-perceived health, is a simple method for evaluating individual's health status. According to the World Health Organization (WHO), SRH is recommended to be used in health interview surveys and considered as a very useful indicator in the field of public health (WHO, 1996).

The measurement of SRH is not time consuming, not burdensome for the respondents and easily applicable to large populations (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006). SRH is commonly used in psychosocial, epidemiological and gerontological studies (Kaplan & Baron-Epel, 2003) and clinical trials (Jylhä, 2009).

The relationship between SRH and mortality in older people has been well documented (Benyamini & Idler, 1999; DeSalvo et al., 2006; Idler & Benyamini, 1997; Moreno, Huerta, & Albala, 2014). Moreover, data collected within repeated cross-sectional survey from 1980 to 2002 in USA, indicated growing predictive value of SRH for mortality (Schnittker & Bacak, 2014). Researchers emphasized that nowadays societies are characterized by increased health awareness related to educational attainment growth, medicalization, development of medical technology and, most of all, access to health information. These indicators have an impact on SRH and, consequently, on its association with mortality.

The assessment of SRH of middle-aged population in Central and Eastern Europe (CEE) and former Soviet Union countries was in the

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scope of research, especially in the context of profound social and economic transformation at the end of 20th century (Bobak, Pikhart, Rose, Hertzman, & Marmot, 2000; Bobak, Murphy, Rose, & Marmot, 2007; Pikhart et al., 2001). The divide between Eastern and Western Europe in SRH, as well as in mortality has been also described (Bobak & Marmot, 1996; Carlson, 1998, 2004).

The relationship between SRH and mortality in older populations has been recently demonstrated for Western European countries and USA (Assari, 2016; Verropoulou, 2014), however, to our best knowledge, there is scarce evidence of such correlation in CEE countries (Bamia et al., 2017; Pac, Tobiasz-Adamczyk, Brzyska, & Florek, 2013; Tobiasz-Adamczyk, Brzyski, & Kopacz, 2008).

The demographic trends in rapidly ageing societies justify scientific efforts to fill this gap and contribute to understanding determinants of survival on the public health level.

The objective of the present study was to evaluate the association of SRH with all-cause mortality among older adults in Poland, participants of a cross-sectional PolSenior project. Specific aim was to assess the relationship between SRH and mortality in terms of gender, socio-economic factors, objective health measures, functional performance and life-style factors.

2. Material and methods

2.1. Study design

The present study is based on data obtained from the PolSenior project, an epidemiologic, multicenter, state-funded research conducted in Poland from 2007 to 2012 in a representative sample of the Polish elderly population. The PolSenior study group consisted of 4979 respondents (48.4% women) aged 65 years and over divided into equally sized five-year age cohorts. Detailed description of the study protocol has been described previously (Bledowski et al., 2011).

Respondents were interviewed face-to-face in their place of residence by trained nurses, who used structured questionnaires addressing medical and socio-economic aspects. Both questionnaires are available online (http://polsenior.iimcb.gov.pl/en/questionnaire). Additionally, blood pressure and anthropometric measurements were performed, blood and urine samples were collected. Ethical approval (No. KNW-6501-38/I//08) was obtained from the Bioethics Commission of the Medical University of Silesia in Katowice. All study participants or their proxies signed informed consent forms.

2.2. Definition of outcome variables

Self-rated health was measured using Visual Analog Scale (VAS), with score range from 0 to 10 points, where 0 meant the worst imaginable health status and 10 the best (Bledowski et al., 2011). SRH evaluation was based on respondents' own judgement and was dedicated to those without moderate or severe dementia (Klich-Raczka et al., 2014) assessed with the Mini Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975). For the purpose of this study, SRH score was arbitrary divided into three categories: 0–3 points – poor, 4–6 points – fair, 7–10 – good health.

In the current study, the 5-year all-cause mortality was taken into account, calculated as the time from the date of the interview to the date of respondent's death (if occurred) or censored to 5 years for respondents who had survived the observation period. The information about dates of deaths was drawn from the Universal Electronic System for Registration of the Population.

The present analyses were performed separately for women and men, because preliminary results revealed gender differences in terms of SRH (Bledowski et al., 2011).

2.2.1. Participants

For the purpose of this study, 885 of 4979 respondents of the PolSenior project were excluded due to problems with completing MMSE or suspicion of at least moderate dementia. Additionally, 45 eligible subjects did not evaluate SRH and thus, the analysed group comprised 4049 respondents (48.0% women). During 5-year period, 1086 respondents (27.0%) died: 414 women (21.4%) and 672 men (31.8%). Details of the study flow are presented in Fig. 1.

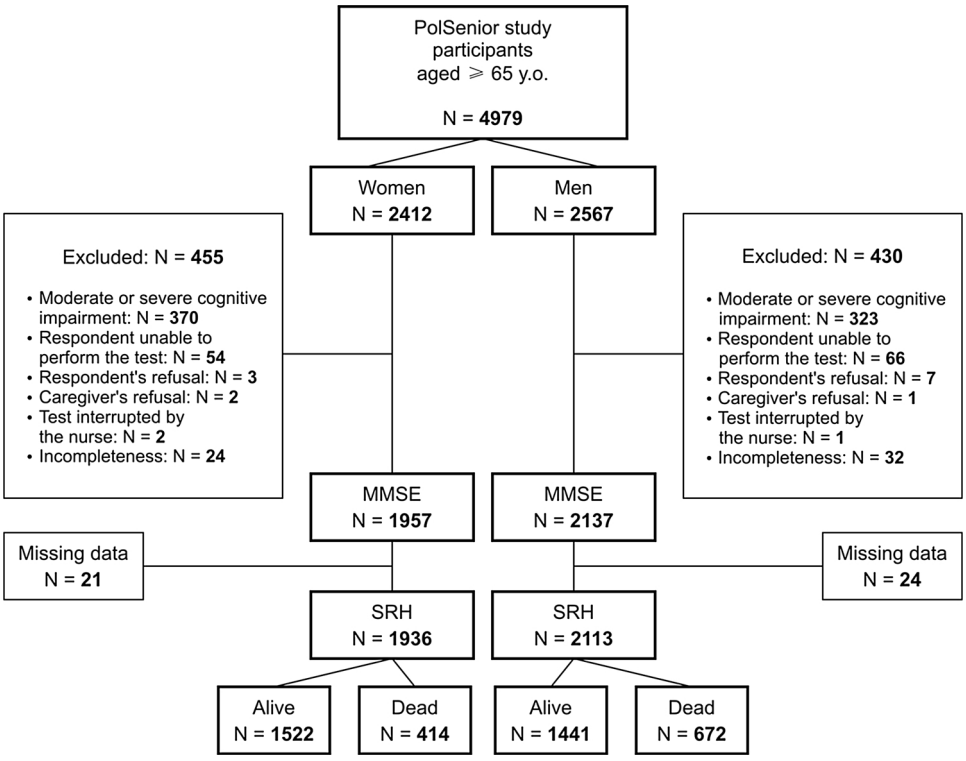

Fig. 1. Study flow.

2.3. Demographic characteristics and socio-economic variables

The following variables were included: gender, age cohort (65–69, 70–74, 75–79, 80–84, 85–89, 90 + years), place of residence (urban or rural area), present marital status (married, divorced or separated, widowed, never married), education level (higher, secondary, vocational, primary, less than primary), type of work before retirement (white-collar worker, farmer, blue-collar worker, other worker, including: salesperson, owner of a trade or service workshop, small entrepreneur, uniformed services officer) and self-assessed economic status (enough money for all needs; enough money to make a living, but not for all needs; not enough money).

2.4. Health status variables

Functional status was assessed using Katz Index of Activities of Daily Living (ADL) and Lawton Instrumental Activities of Daily Living Scale (IADL) (Katz, Downs, Cash, & Grotz, 1970; Lawton & Brody, 1969). According to the ADL score, respondents were classified as: dependent (0–2 points), partially dependent (3–4 points) and independent (5–6 points). Participants with the IADL score 8–18 points were classified as dependent, 19–23 points as partially dependent, 24 points as independent.

Interpretation of visual and hearing assessment has been previously described (Skalska et al., 2013). In the current analysis, respondents were assigned to the following groups: normal vision, impaired vision (including moderate, significant impairment or blindness), normal or impaired hearing.

The number of chronic diseases was calculated on the basis of medical history questionnaire. The following clinical conditions were taken into account: cardiovascular diseases (including arrhythmia, atrial fibrillation, ischemic heart disease, myocardial infarction, heart failure), nervous system diseases (stroke, Parkinson's disease, epilepsy), cancer, respiratory system diseases (chronic obstructive pulmonary disease, emphysema, chronic bronchitis, asthma), anaemia, osteoporosis, hepatitis B or C, gastric or duodenal ulcer, hyperthyroidism or hypothyroidism. Moreover, diagnosis of arterial hypertension, chronic kidney disease, diabetes was established as described earlier (Chudek et al., 2014; Zdrojewski et al., 2016).

Depressive symptoms were assessed using the 15-item version of the Geriatric Depression Scale (GDS-15) (Sheikh & Yesavage, 1986). Respondents were classified into three groups using cut-off points accepted in other studies: non-depressed (0–5 points), moderately depressed (6–10 points) and severely depressed (11–15 points) (Herrmann et al., 1996; Lacruz et al., 2012).

2.5. Life-style factors

Current smoking status (active smoker, ex-smoker, never-smoker) was assessed and frequency of alcohol consumption within the last 12 months was evaluated.

Participants were classified as physically active or inactive, depending on the type and intensity of activities in the past 12 months as described elsewhere (Rowinski, Dabrowski, & Kostka, 2015).

Body height was measured using a portable personal measuring device and body weight using Tanita BC-536 scale (Zdrojewski et al., 2016). Body mass index (BMI) was calculated and categorized according to the WHO criteria including underweight, normal weight, overweigh and obesity (class I-III) (WHO, 2000).

2.6. Statistical analysis

All statistical analyses were performed using Statistica 10.0 software (StatSoft, Tulsa, OK., USA) and the R (R Foundation for Statistical Computing, Vienna, Austria) programs separately for women and men. Relationship between the analyzed factors and SRH was assessed using X^2 test with the significance level of 0.05. To examine the association between SRH and all-cause mortality in the analyzed time period, survival curves using Kaplan–Meier estimates were computed. Log-rank test was also performed. The 5-year hazard ratio (HR) of death and 95% confidence intervals (95%CIs) were calculated. Initially, univariate Cox proportional hazard regression models were developed, then adjusted for age as continuous variable. Afterwards, multivariate Cox proportional hazard regression models including factors significantly associated with SRH in the study group were developed. In these models, IADL was chosen as a determinant of functional status. Proportional-hazards assumption was tested using Schoenfeld residuals. Due to some missing data, analyses of particular variables differed in terms of the total number of subjects.

3. Results

3.1. Characteristics of the study group

Baseline characteristics of women and men according to categories of SRH is presented in Table 1. Four out of ten respondents (40.2%: 36.6% of women and 43.5% of men, $p < 0.001$) reported good SRH, every second (51.7%: 54.4% of women and 49.3% of men, $p = 0.001$) fair SRH, and less than one in ten (8.1%: 9.0% of women and 7.2% of men, $p = 0.042$) poor SRH.

Respondents characterized by advanced age, lower economic status, dependence in ADL or IADL, visual or hearing impairment, depressive symptoms, alcohol abstention (consumption once a year or less), low physical activity and multimorbidity were more likely to evaluate their health as poor.

Other factors significantly related to SRH in women, but not in men were: level of education, type of work and BMI. A positive association of SRH with higher level of education and, consequently, with white-collar work was observed. The risk of poor SRH was the highest among women farmers. Women with BMI $< 18.5\,kg/m^2$ ($N = 19$) and $\geq 40.0\,kg/m^2$ ($N = 68$) were more likely to assess their health as poor.

The analysis of the distribution of SRH revealed significant differences between women and men in two out of six age cohorts, namely: 70–74 years old ($p = 0.049$) and 75–79 years old ($p < 0.001$).

3.2. Kaplan–Meier survival curves and univariate Cox regression analysis

Kaplan–Meier survival curves for women and men are presented in Fig. 2. Log-rank test showed significant differences in 5-year survival according to categories of SRH for both genders ($p < 0.001$).

The percentages of women who have died during the observation time period were 17.5% among those with good SRH, 21.6% with fair SRH and 36.2% with poor SRH. Among men, the values were 26.6%, 32.9% and 55.3%, respectively.

Univariate Cox proportional hazard regression model revealed that change in hazard ratio for 5-year all-cause mortality between different categories of SRH was similar for both genders. Hazard ratios for fair compared to good SRH was 1.29 (95%CI: 1.03–1.60); $p = 0.024$ for women and 1.29 (1.10–1.52); $p = 0.002$ for men. Women and men who reported poor health had over two-fold higher risk of death than those who rated their health as good [HR = 2.48 (1.83–3.37); $p < 0.001$, HR = 2.62 (2.04–3.36); $p < 0.001$, respectively].

After adjustment for age, hazard ratio for mortality among women with fair compared to good SRH was 1.18 (0.95–1.46); NS, and among men 1.15 (0.97–1.35); NS. The evaluation of poor compared to good health led to HR for mortality of 1.98 (1.46–2.68); $p < 0.001$ for women and 2.06 (1.60–2.64); $p < 0.001$ for men.

3.3. Multivariate Cox regression analysis

Factors significantly related to SRH in the study group (Table 1), such as: age, level of education, type of work, self-report economic

Table 1
Characteristics of the study population according to SRH and variables: socio-demographic (A), health and life-style (B).

Variable	Characteristics	Women					Men				
		n	Poor SRH [%]	Fair SRH [%]	Good SRH [%]	P-value	n	Poor SRH [%]	Fair SRH [%]	Good SRH [%]	P-value
A) Socio-demographic variables											
Age cohort		*N = 1936*[a]					*N = 2113*				
	65–69 y.o.	394	5.6	47.5	47.0	< 0.001	364	6.0	44.5	49.5	< 0.001
	70–74 y.o.	432	6.7	55.1	38.2		447	4.9	49.0	46.1	
	75–79 y.o.	359	10.0	57.4	32.6		385	5.7	42.6	51.7	
	80–84 y.o.	289	11.1	56.4	32.5		351	6.3	56.1	37.6	
	85–89 y.o.	280	12.5	57.5	30.0		351	10.0	55.8	34.2	
	90 y.o. and over	182	11.0	53.8	35.2		215	13.5	47.9	38.6	
Place of residence		*N = 1936*					*N = 2113*				
	Urban area	1,157	8.6	54.5	36.8	NS	1,326	7.5	48.3	44.2	NS
	Rural area	779	9.5	54.2	36.3		787	6.7	50.8	42.4	
Marital status		*N = 1868*					*N = 2051*				
	Married	600	8.2	51.2	40.7	NS	1,492	6.8	48.2	45.0	NS
	Divorced or separated	45	8.9	55.6	35.6		45	8.3	50.4	41.3	
	Widowed	1,161	9.6	55.7	34.6		470	13.3	55.6	31.1	
	Never married	62	9.7	54.8	35.5		44	4.5	59.1	36.4	
Education level		*N = 1870*					*N = 2054*				
	Higher	173	4.6	44.5	50.9	< 0.001	287	5.9	49.5	44.6	NS
	Secondary	391	7.2	55.8	37.1		452	7.5	46.5	46.0	
	Vocational	146	6.8	47.9	45.2		382	6.5	49.5	44.0	
	Primary	920	9.3	56.2	34.5		773	7.0	49.8	43.2	
	Less than primary	240	16.3	54.6	29.2		160	11.9	52.5	35.6	
Type of work		*N = 1714*					*N = 2038*				
	White-collar worker	517	6.0	53.8	40.2	0.001	592	7.6	46.6	45.8	NS
	Farmer	517	14.6	56.9	28.5		203	8.9	52.7	38.4	
	Blue-collar worker	792	8.8	54.2	37.0		1,116	6.7	49.6	43.7	
	Other worker[b]	124	7.3	56.5	36.3		127	7.9	49.6	42.5	
Self-reported economic status		*N = 1788*					*N = 1976*				
	Enough money for all needs	1,140	8.0	51.8	40.2	< 0.001	1,491	6.3	48.6	45.1	0.016
	Enough money to make a living, but not for all needs	556	10.4	58.6	30.9		438	8.9	50.0	41.1	
	Not enough money	92	16.3	53.3	30.4		47	17.0	48.9	34.0	
B) Health and life-style variables											
ADL status		*N = 1916*					*N = 2086*				
	Independent	1,819	8.2	54.0	37.8	< 0.001	1,981	5.8	49.4	44.9	< 0.001
	Partially dependent	74	21.6	62.2	16.2		77	33.8	50.6	15.6	
	Dependent	23	34.8	39.1	26.1		28	42.9	32.1	25.0	
IADL status		*N = 1927*					*N = 2104*				
	Independent	1,051	4.6	50.4	45.0	< 0.001	1,209	3.3	43.8	52.9	< 0.001
	Partially dependent	495	10.1	60.4	29.5		506	6.5	55.1	38.3	
	Dependent	381	19.9	57.5	22.6		389	20.1	58.9	21.1	
Vision		*N = 1886*					*N = 2063*				
	Normal	1,487	7.4	53.9	38.7	< 0.001	1,490	5.6	47.9	46.5	< 0.001
	Impaired	399	14.5	56.1	29.3		573	11.3	54.1	34.6	
Hearing		*N = 1906*					*N = 2081*				
	Normal	1,065	7.4	54.8	37.7	0.038	1,155	5.8	47.0	47.2	< 0.001
	Impaired	841	10.7	54.0	35.3		926	8.6	51.9	39.4	
Number of chronic diseases		*N = 1837*					*N = 2051*				
	0	54	1.9	40.7	57.4	< 0.001	114	3.5	34.2	62.3	< 0.001
	1–5	1,614	8.0	53.7	38.4		1,800	6.3	49.3	44.4	
	6 or more	169	16.6	66.3	17.2		137	19.0	57.7	23.4	
GDS-15 score		*N = 1893*					*N = 2075*				
	Non-depressed	1,208	3.6	49.7	46.7	< 0.001	1,554	4.0	46.0	50.0	< 0.001
	Moderately depressed	547	15.5	63.3	21.2		448	14.1	58.5	27.5	
	Severely depressed	138	26.8	60.1	13.0		73	34.2	53.4	12.3	
Smoking status		*N = 1913*					*N = 2075*				
	Never-smoker	1,533	9.3	54.4	36.3	NS	673	6.8	45.9	47.3	NS
	Ex-smoker	285	7.7	53.3	38.9		1,105	7.7	51.5	40.8	
	Active smoker	95	5.3	53.7	41.1		297	6.1	49.2	44.8	
Alcohol consumption		*N = 1916*					*N = 2093*				
	Once a year or less	1,179	11.0	56.6	32.4	< 0.001	611	10.6	51.1	38.3	0.001
	Several times a year	612	6.0	51.8	42.2		934	5.7	48.8	45.5	
	Several times a month	93	4.3	41.9	53.8		327	5.2	48.6	46.2	
	Several times a week	32	6.3	53.1	40.6		221	5.9	47.5	46.6	
Physical activity		*N = 1936*					*N = 2113*				
	Yes	276	4.3	51.4	44.2	0.001	525	2.5	40.8	56.8	< 0.001
	No	1,660	9.8	54.9	35.4		1,588	8.8	52.1	39.2	

(*continued on next page*)

Table 1 (*continued*)

Variable	Characteristics	Women					Men				
		n	Poor SRH [%]	Fair SRH [%]	Good SRH [%]	P-value	n	Poor SRH [%]	Fair SRH [%]	Good SRH [%]	P-value
BMI		*N = 1876*					*N = 2062*				
	Underweight (< 18.5)	19	15.8	47.4	36.8	0.002	28	10.7	53.6	35.7	NS
	Normal weight (18.5–24.9)	405	8.4	56.0	35.6		551	7.3	43.4	49.4	
	Overweight (25.0–29.9)	690	7.1	52.6	40.3		935	6.1	51.2	42.7	
	Obese class I (30.0–34.9)	483	8.5	57.8	33.7		442	6.6	50.2	43.2	
	Obese class II (35.0–39.9)	211	8.5	54.5	37.0		88	8.0	59.1	33.0	
	Obese class III (≥ 40.0)	68	23.5	48.5	27.9		18	11.1	50.0	38.9	

[a] Due to deletion of missing data presented analyses differed in terms of the number of observations.
[b] Other worker including salesperson, owner of a trade or service workshop, small entrepreneur, uniformed services officer.

status, IADL, vision, hearing, number of chronic diseases, GDS-15, alcohol consumption, physical activity and BMI, were afterwards included into the multivariate Cox proportional hazard regression models.

The analysis revealed significant difference in the risk of mortality only between women with a perception of poor vs. good health. No significant differences between SRH and mortality were found in men (Table 2).

An increased risk for mortality was found in women aged 75 and older and men aged 80 and older as compared to the youngest age group. Low IADL status and physical inactivity augmented mortality in both genders.

The variable independently related to all-cause mortality only in women, but not in men, was the type of work before retirement. Among women, lower hazard ratio for mortality was noted among those who had been farmers than among white-collar workers.

Factors related to mortality exclusively in men were BMI and the number of chronic conditions. Interestingly, lower risk of death was found in overweight as compared to normal weight men. Those who had been diagnosed with six or more diseases had nearly three times greater risk of death than those who reported no chronic health problems.

There was no relationship between mortality and the following variables both in women and in men: education level, self-report economic status, vision, hearing and depressive symptoms.

4. Discussion

Providing data about health and its determinants among older adults is of importance for CEE countries, including Poland, placed nowadays among the fastest aging societies in Europe.

The results of the present study demonstrated an association between SRH and mortality in Polish Caucasians aged 65 years and over.

In the period under review, higher percentages of deaths were observed among men (31.8%) than women (21.4%), which is in line with global demographic trends (OECD, 2015). The percentages of deceased respondents increased by 18.7% in women and 28.7% in men when subgroups with poor and good SRH were compared. Consequently, in univariate Cox regression analysis, perception of poor SRH in comparison to good one led to hazard ratio for mortality of 2.48 for women and 2.62 for men. However, after adjustment for age, the relationship between SRH and mortality lost its significance in women and men with fair SRH, but remained significant for women and men with poor versus good SRH.

Multivariate Cox proportional hazard regression model adjusted for factors significantly related to SRH revealed no SRH-mortality

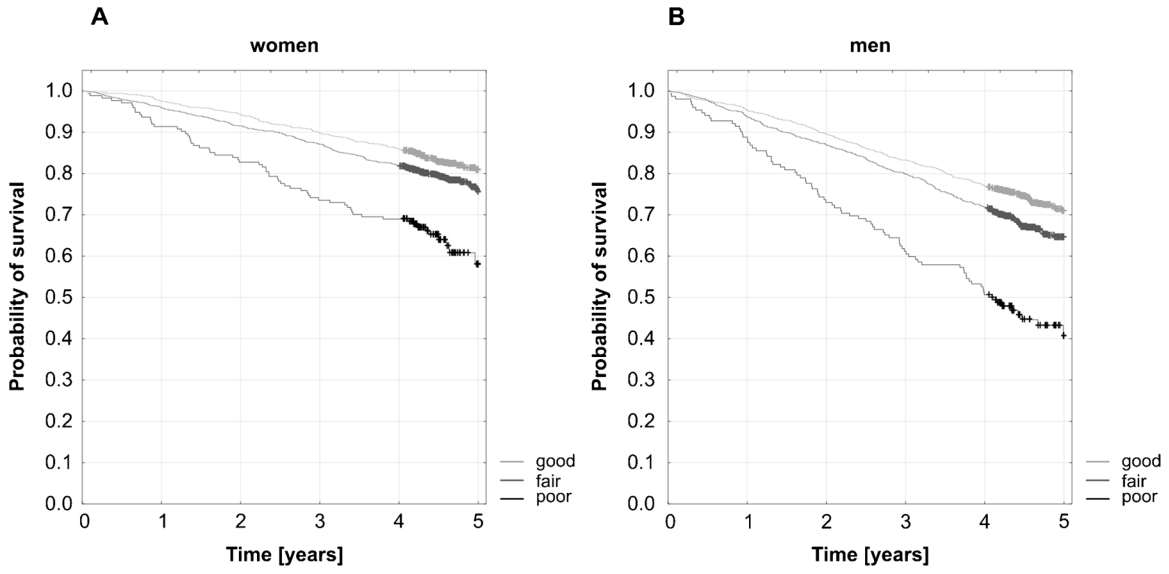

Fig. 2. Kaplan-Meier survival curves.

Table 2
Multivariate Cox proportional hazards regression models including factors significantly associated with SRH for women and men.

Variable	Characteristics	Women			Men		
		Hazard ratio	95%CI	P-value	Hazard ratio	95%CI	P-value
Self rated-health	Good	reference	–	–	reference	–	–
	Fair	1.19	0.92-1.55	NS	0.95	0.79-1.14	NS
	Poor	1.70	1.16-2.50	0.007	1.20	0.89-1.61	NS
Age cohort	65–69 y.o.	reference	–	–	reference	–	–
	70–74 y.o.	1.08	0.62-1.90	NS	1.29	0.90-1.85	NS
	75–79 y.o.	1.80	1.06-3.05	0.029	1.37	0.96-1.97	NS
	80–84 y.o.	2.14	1.27-3.62	0.004	2.66	1.90-3.72	< 0.001
	85–89 y.o.	3.29	1.96-5.51	< 0.001	3.10	2.22-4.31	< 0.001
	90 y.o. and over	6.37	3.77-10.76	< 0.001	4.64	3.26-6.59	< 0.001
Type of work	White-collar worker	reference	–	–	reference	–	–
	Farmer	0.52	0.36-0.77	0.001	0.76	0.56-1.01	NS
	Blue-collar worker	1.03	0.77-1.38	NS	0.97	0.80-1.17	NS
	Other worker[a]	1.03	0.64-1.65	NS	0.78	0.52-1.17	NS
IADL status	Independent	reference	–	–	reference	–	–
	Partially dependent	1.78	1.27-2.50	0.001	1.49	1.21-1.84	< 0.001
	Dependent	3.88	2.72-5.52	< 0.001	2.32	1.85-2.91	< 0.001
BMI	Underweight (< 18.5)	1.19	0.55-2.58	NS	1.15	0.68-1.92	NS
	Normal weight (18.5–24.9)	reference	–	–	reference	–	–
	Overweight (25.0–29.9)	0.75	0.56-1.01	NS	0.81	0.67-0.97	0.026
	Obese class I (30.0–34.9)	0.78	0.56-1.07	NS	0.84	0.66-1.07	NS
	Obese class II (35.0–39.9)	0.74	0.48-1.14	NS	0.88	0.57-1.38	NS
	Obese class III (≥40.0)	0.96	0.49-1.88	NS	0.88	0.36-2.16	NS
Physical activity	Yes	reference	–	–	reference	–	–
	No	3.94	1.83-8.45	< 0.001	1.69	1.31-2.17	< 0.001
Number of chronic diseases	0	reference	–	–	reference	–	–
	1–5	1.29	0.52-3.16	NS	1.51	0.98-2.33	NS
	6 or more	1.02	0.39-2.67	NS	2.70	1.64-4.46	< 0.001

*Variables included in the multivariate Cox proportional hazards regression models: age, education, type of work, self-report economic status, IADL, vision, hearing, number of chronic diseases, GDS-15 scoring, alcohol consumption, physical activity and BMI. Table 2 contains only factors significantly associated with mortality.
[a] Other worker including salesperson, owner of a trade or service workshop, small entrepreneur, uniformed services officer.

association in men. Significant association was detected only between women reporting poor and good health.

Some previous studies have found SRH as a better predictor of mortality in older women than men (Ernstsen, Nilsen, Espnes, & Krokstad, 2011; Grant, Piotrowski, & Chappell, 1995; Lyyra, Leskinen, Jylhä, & Heikkinen, 2009; McCallum, Shadbolt, & Wang, 1994; Onawola & LaVeist, 1998; Pac et al., 2013), while others revealed the opposite findings (Assari, 2016; Deeg & Kriegsman, 2003; Helmer, Barberger-Gateau, Letenneur, & Dartigues, 1999; Nishi et al., 2012; Okamoto, Momose, Fujino, & Osawa, 2008; Spiers, Jagger, Clarke, & Arthur, 2003).

The PolSenior project data are in line with results of the Longitudinal Study on Ageing (LSOA) presented by Onawola and LaVeist (1998). These researchers revealed that SRH was an independent predictor of 6-year mortality for African-American women aged 50 years and over, but not for men. Furthermore, they showed significant mortality risk difference only between women with poor and excellent SRH. The results of the Ageing and the Family Project Survey showed that SRH was an independent predictor of survival among Australian older women. The relative risks of death for fair and good SRH remained significantly higher than for excellent SRH after adjustment for major illnesses, disability, depression and social support. In men, no significant differences were found, regardless of SRH categories (McCallum et al., 1994). The stronger effect of SRH on mortality in older women than men was also indicated in the Evergreen project conducted in central Finland (Lyyra et al., 2009). Additionally, the 20-year observation of older citizens of Krakow, Poland, demonstrated poor SRH as a strong, independent and stable over time predictor of mortality among older women (Pac et al., 2013). It seems that the gender gap might be at least partially explained by better health-awareness among women (Bacak & Olafsdottir, 2017; Dahlin & Harkonen, 2013).

Dowd and Zajacova (2007) revealed that a relationship between SRH and mortality is strongly related to socio-economic status, as well as education in U.S. population. In the PolSenior study, SRH was dependent on socioeconomic status in both genders and on education in women. However, in the multivariate regression model no association of the above confounders with mortality was found.

Recent analysis of the results of the Third National Health and Nutrition Examination Survey (NHANES III) advised cautiousness in interpretation of SRH and health risks across socio-economic status groups (Dowd & Zajacova, 2010). This required special consideration in the process of comparing surveys conducted in highly developed societies and countries with lower socio-economic status. In this perspective, the PolSenior study is a unique research project assessing SRH-related factors and mortality in CEE region.

One of the advantages of our study was a large proportion of respondents of advanced age (80–89 y.o.; 31.4%) and long-lived individuals (aged 90 years and over; 9.8%), who are often at risk of being excluded from population-based studies due to their health issues and relatively low number in general population. Adequate proportions of men and women within each age group achieved in the PolSenior study should be considered as an additional strong point. The above allowed the authors to conduct reliable comparisons between and within age groups. Sample draw procedure in the PolSenior project could be an example for other studies, including clinical trials, in which inadequate

number of the oldest participants, especially men, may lead to bias. Moreover, the PolSenior project, which was an interdisciplinary research, allowed us to include in analysis numerous additional factors regarding socio-demographic features, health status, life style, and socio-economic status. Additionally, collecting information during face-to-face interviews by trained nurses ensured the validity, reliability, accuracy and quality of gathered data.

The use of the Visual Analog Scale for evaluation of SRH may be perceived as a subject for discussion or even controversy concerning methodology applied in the PolSenior study. WHO recommended SRH assessment based on listed response categories to a single question referring to general (overall) health (WHO, 1996). In the present study, VAS was chosen as a simple and respondent-friendly method, which is of key importance in population-based surveys involving older participants. VAS seems an efficient SRH screening tool in the PolSenior study group. Only 45 (1%) eligible respondents did not self-assess their SRH (Fig. 1).

The limitation of the study was lack of information about cause-specific mortality of the PolSenior study respondents. These data could not be obtained due to law restriction concerning access to personal information in Poland.

For ensuring reliability of data on SRH, relatively large group of PolSenior respondents (18.7%) with cognitive or significant sensory impairment was excluded. Therefore, presented findings might be generalized only to the older population with preserved cognitive functions.

Further research in this field should include a comparative analysis of different methods of SRH evaluation, including VAS among older adults.

5. Conclusions

The present study extends knowledge about the association between SRH and mortality in older adults in CEE region, as well as supports the existing evidence that SRH is an independent predictor for mortality in older women.

Accelerated ageing of populations and increasing life expectancy of seniors warrants designing studies to assess relationship between self-assessed and objective measures of health in old and long-lived individuals.

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Conflict of interest

The authors have no conflict of interests to declare.

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